

A SEMI-ANNUAL AQUATIC MONITORING REPORT FOR A SURFACE MINE PERMIT (DMLR # 1101760) LOCATED NEAR ROARING FORK IN WISE COUNTY, VIRGINIA

Prepared for: Red River Coal Company, Inc

Authored by:

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ATS PROJECT NO. 1199.01

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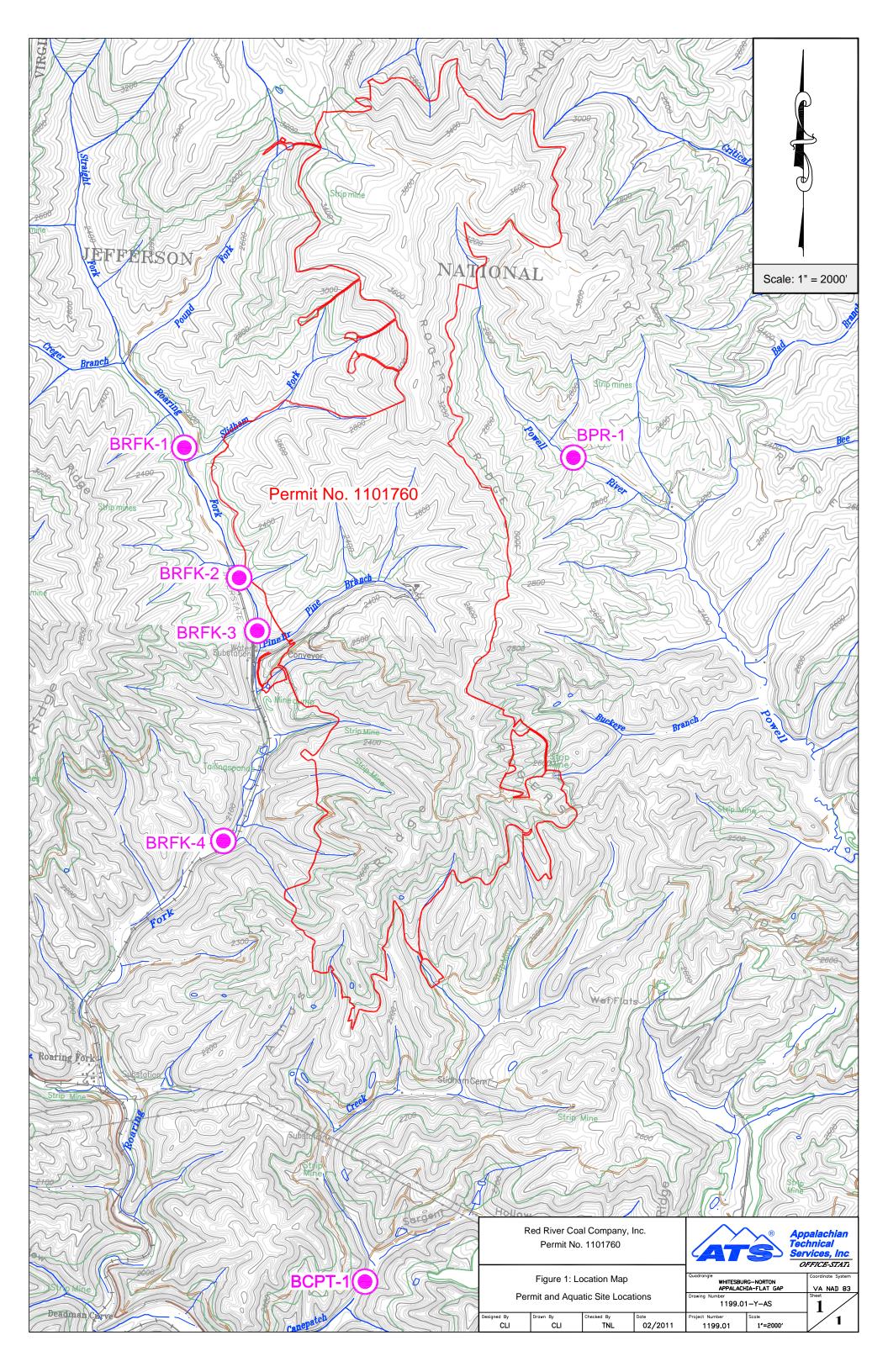
I. INTRODUCTION

Appalachian Technical Services, Inc. was contracted by Red River Coal Company, Inc to conduct ongoing semi-annual (spring and fall) aquatic monitoring at six sites within the Guest River drainage in Wise County, Virginia. This report represents the spring 2012 aquatic biological assessments of six sample sites. The permit boundary and sample site locations are shown on the attached topographical map in Figure 1.

II. METHODS

General locations of all sample sites were selected by a Virginia DMLR biologist. However, the exact site locations may have been relocated by ATS senior biologists due to site conditions (*i.e.* low flow, lack of riffle habitat, etc.) and accessibility. Aquatic sampling site BRFK-1 was located on Roaring Fork approximately 50 m upstream of the confluence with Stidham Fork (37.0128; 82.72918). Aquatic sampling site BRFK-2 was located on Roaring Fork approximately 400 m upstream of sample site BFRK-3 (37.00595; 82.72583). Aquatic sampling site BRFK-3 was located on Roaring Fork approximately 50 m upstream of the confluence to Pine Branch (37.00037; 82.72239). Aquatic sampling site BRFK-4 was located southeast of the permit on Roaring Fork approximately 450 m downstream of a series of sediment ponds (39.98554; 82.72417). Aquatic sampling site BCPT-1 was southeast of the permit and located on Canepatch Creek approximately 100 m downstream of the confluence to Sargent Hollow (36.97016; 82.70624). Aquatic sampling site BPR-1 was located to the east of the permit boundary in the upper headwaters of the Powell River approximately 50 m upstream of Red River Coal Company's haulroad (37.01271; 82.69608).

Data collections for the aquatic biological assessment consisting of habitat data, macroinvertebrates and physiochemical water quality data were collected on 14 March 2012 by ATS Biological Technicians Brian Bledsoe, Joseph Day and James Breeding.



A. Habitat Assessments

Rapid Bioassessment Protocol (RBP) high gradient data sheets were used to assess the habitat for each stream. The RBP sheets score each site's habitat based on 10 criteria with 1 - 20 possible points each (for a max total of 200). Based on the 2008 Methods for Assessing Biological Integrity of Surface Waters in Kentucky, Revision 3 (KDOW 2008), stream habitat in the central Appalachians Ecoregion is considered not supporting its designated use if the total score is less than or equal to 116 total points. Habitat must score 117 – 159 to achieve a partially supporting criterion. To qualify as fully supporting habitat, it must score at least 160 total points. Copies of the stream habitat data sheets are attached in Appendix A.

B. Aquatic Macroinvertebrates

Macroinvertebrates were collected using the single habitat approach as described in sections 7.1.1 and 7.3.1 of the *Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition* (Barbour *et al.* 1999).

Macroinvertebrates were collected by agitating a riffle area of 0.25 meters in front of a standard size (500 Φ m mesh) kicknet. This process was repeated eight times to achieve 2 square meters of sample area. Upon collection, samples from each site were placed in individual containers of 95% ethyl alcohol, labeled, and returned to the lab.

Subsampling procedures followed methods within Appalachian Technical Services, Inc.'s Virginia Department of Environmental Quality approved *Quality Assurance Project Plan for Biological Monitoring, 2010* and resulted in the identification of approximately 110 (±10%) individuals. All macroinvertebrates were identified by a North American Benthological Society certified taxonomist to family level with the exception of Chironomidae and Oligochaeta.

Macroinvertebrate metrics were calculated based on the methods included in *A Stream Condition Index for Virginia Non-Coastal Streams* (Tetra Tech, Inc. 2003). ATS

biologists used the Ecological Data Application System (EDAS) to statistically rarify the samples to 110 organisms and calculate VSCI scores. The VSCI is used to compare streams to reference conditions to evaluate a streams current health. A stream must score a 61 or above to qualify as acceptable water quality. In order to calculate the VSCI the following metrics were calculated from the family level aquatic macroinvertebrate data: Taxa richness; Ephemeroptera, Plecoptera, Trichoptera (EPT) Index; Percent Ephemeroptera; Percent Plecoptera + Trichoptera (less Hydropsychidae); Percent Scrapers; Percent Chironomidae; Percent of top two dominant families; and Family Biotic Index (FBI). Tables with the macroinvertebrate data are attached in Appendix B.

C. Physiochemical Water Data

Prior to any field data collections, all handheld meters were calibrated. Four water quality parameters (specific conductance, dissolved oxygen, pH, and temperature) were analyzed using a handheld meter (YSI Pro Plus). Upon return to the lab all meters received a post-calibration check to ensure validity of all measurements recorded.

III. RESULTS

A. Habitat Assessments

The stream habitat at BRFK-1 scored 133 of 200 (Appendix A), indicating the habitat is partially supporting aquatic life. The stream was approximately 18 feet wide and characterized mostly by a series of riffles and runs (Figures 2 and 3). Flow occupied >75% of the stream channel. Embeddedness was suboptimal with approximately 25 to 50% of the substrate particles surrounded by fine sediment. The water was clear and there was slight siltation within the streambed. The stream banks were moderately stable but the left bank had a narrow riparian zone. The substrate was mostly gravel and cobble.

The stream habitat at BRFK-2 scored 126 of 200 (Appendix A), indicating the habitat is partially supporting aquatic life. The stream was approximately 18 feet wide

and characterized mostly by a series of riffles and runs (Figures 4 and 5). Flow occupied >75% of the stream channel. Embeddedness was suboptimal with 25 to 50% of the substrate particles surrounded by fine sediment. The coloration of the water was clear and there was evidence of slight siltation within the streambed. The stream banks were moderately stable but the right bank had a narrow riparian zone. The substrate was mostly gravel and cobble.

The stream habitat at BRFK-3 scored 130 of 200 (Appendix A), indicating the habitat is partially supporting aquatic life. The stream was approximately 20 feet wide and characterized mostly by a series of riffles and runs (Figures 6 and 7). Flow occupied >75% of the stream channel. Embeddedness was suboptimal with 25 to 50% of the substrate particles surrounded by fine sediment. The coloration of the water was clear and there was evidence of slight to moderate siltation within the streambed. The left stream bank vegetative protection and riparian width were suboptimal to optimal while the right was marginal to suboptimal. The substrate was mostly gravel and cobble.

The stream habitat at BRFK-4 scored 119 of 200 (Appendix A), indicating the habitat is partially supporting aquatic life. The stream was approximately 20 feet wide and characterized mostly by a series of riffles and runs (Figures 8 and 9). Flow occupied >75% of the stream channel. Embeddedness was suboptimal with approximately 25 to 50% of the substrate particles surrounded by fine sediment. The coloration of the water was clear and there was evidence of moderate sedimentation within the streambed. Both stream banks had suboptimal vegetation and good riparian zones. The substrate was mostly gravel and cobble.

The stream habitat at BCPT-1 scored 123 of 200 (Appendix A), indicating the habitat is partially supporting aquatic life. The stream was approximately 10 feet wide and was series of riffles, runs and pools (Figures 10 and 11). Flow occupied >75% of the stream channel. Embeddedness was suboptimal with 25 to 50% of the substrate particles surrounded by fine sediment. The coloration of the water was clear and there

was evidence of moderate sedimentation within the streambed. The stream banks were moderately unstable and the right bank had a narrow riparian area. The substrate was mostly gravel and cobble.

The stream habitat at BPR-1 scored 129 of 200 (Appendix A), indicating the habitat is partially supporting aquatic life. The stream was approximately 5 feet wide and characterized mostly by a series of runs and riffles (Figures 12 and 13). Flow occupied >75% of the stream channel. Embeddedness was suboptimal with approximately 25 to 50% of the substrate particles surrounded by fine sediment. The coloration of the water was clear and there was evidence of slight siltation within the streambed. The stream banks were unstable but with good riparian areas. The substrate was mostly gravel.

B. Macroinvertebrates

Sample site BPR-1 had the highest Taxa Richness (Tables 1 and 2). Sample site BRFK-3 had the lowest Taxa Richness (Tables 1 and 2). Sample site BPR-1 had the lowest FBI score (3.35), indicating excellent water quality with organic pollution unlikely (Table 2). FBI scores for the six sample sites indicated fairly poor (5.77) to excellent (3.35) water quality (Table 2). VSCI scores for the six aquatic sample sites ranged from a low of 28.71 (BRFK-3) to a high of 66.66 (BPR-1) (Table 2).

C. Physiochemical Water Data

All handheld meters passed post-calibration tests. Specific conductances for the six sites ranged from 807 μ S (BCPT-1) to 1182 μ S (BRFK-2) (Table 3). The pH values ranged from 7.97 (BRFK-1) to 8.37 (BRFK-4) (Table 3).

IV. CONCLUSION

Based on RBP habitat data, all six sample sites appear to be somewhat impaired. Habitat assessments revealed that the habitat was marginal to suboptimal at all six sample sites. Only sample site BPR1 had a VSCI score above the unimpaired threshold of 61. The other five sample sites had low percent Ephemeroptera, low

percent scrapers, and high percent two dominants. These low parameter indices may have contributed to the sample sites receiving poor VSCI scores. All water parameters recorded with a handheld meter were within normal limits with an exception of elevated specific conductances at all six sample sites.



Figure 2: BRFK-1 upstream view



Figure 3: BRFK-1 downstream view



Figure 4: BRFK-2 upstream view



Figure 5: BRFK-2 downstream view



Figure 6: BRFK-3 upstream view



Figure 7: BRFK-3 downstream view



Figure 8: BRFK-4 upstream view



Figure 9: BRFK-4 downstream view



Figure 10: BCPT-1 upstream view



Figure 11: BCPT-1 downstream view



Figure 12: BPR-1 upstream view



Figure 13: BPR-1 downstream view

Literature Cited

- Barbour, M. T., J. Gerritsen, B. D. Snyder, and J. B. Stribling. 1999. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C.
- Kentucky Division of Water (KDOW), 2008. Methods for assessing biological integrity of surface waters in Kentucky, Revision 3. Kentucky Department of Environmental Protection, Division of Water, Frankfort, Kentucky.
- Tetra Tech, Inc. 2003. A Stream Condition Index for Virginia Non-Coastal Streams. Tetra Tech, Inc. Owings Mills, Maryland. Prepared for Virginia Department of Environmental Quality, Richmond, Virginia.

APPENDIX A:

RBP DATA

Field Team: Je Stream Name: Ro	39.01-BRFK Ed B, BWB, 500 St Oring Fork Lo D/14/12 La ochemical	oregion: prey Reason: Bio. cation: 50m odjox atitude: 37.0 2 8 pH: 7.9 Conductivity: Did instrument		Land Use Mining Start Time: 14:16 Start Time: 14:45 Start Time: 14
Method used (circle) Riffle Quality (circle)	nvertebrate Collect le one) Singl le one) Good circle one) Kiffle	Habital (Riffle)	Multi Hal Poor None Banks Vegelation	Oltat (Logs, plants, etc) Area Sampled (sq. m.):
Recent precipitation Stream flow (circle)	frele one) Cloudy (circle one) Clear one) Low M WATERSHED S:	Chowers	Above Normal Floor FEATUREES;	Other
Stream Wid Range of Do Average Ve Discharge Est, Reach I	epth <u>0.2-1-0</u> ft locity ft/s cfs	Surface Mining Deep Mining θ Oil Wells θ Land Disposal	θ Construction θ Commercial θ Industrial θ Row Crops	 Forest θ Pasture/Grazing θ Silviculture θ Urban Runoff/Storm Sewers
0 Island 6 0 Other Riparian Ve Dominate Ty	Bridge Abutments Waterfalls getation: Dom. Tree/S ype: Rodadodre Shrubs Birch Otterbaceous maple	hrub Taxa Canopy Co O Fully Sha Partially O Partially	9 Pooled θ Low Norm 9 Very Rapid or Torrential ver: Chan ided (75-100%) θ Dre Shaded (50-75%) θ Cha	Stream Type: al Perennial & Intermittent
Substrate θi		iffie 30 %	Run_70_%	Paol
1. Epifaunal Substrate/Available Cover	Optimal Greater then 70% of substratavorable for epifauna colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonizatio potential (i.e. logs/snags tha are not now fall and not tranisent).r	well suited for full colonization potential; adequate habitat for maintenance of population presence of additional n substrato in the form of ne	Marginal itat; 20-40% mix of stable habitat; habitat avallability less than destrable; sbustrate is; frequently disturbed or removed.	Poor Less than 20% stable habitat, lack of habitat is obvious; substrate unstable or lacking.
SCORE 2. Embeddedness	Optimal Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	15 14 (3) 12 11 Suboptimel Gravel, cobble, and boulder particles are 25 50% surrounded by fine sediment.		Poor Gravel, cobble, and boulder partitices are more than 75% surrounded by fine sediment.
3, Velocity/Depth Regime	20 19 18 17 16 Optimal CoverAll four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). Slow is <0.3 m/s, deep is >0.5 20 19 18 17 16	15 (4) 13 12 11 Suboptimal Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	10 9 8 7 6 Marginal Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Poor Dominated by 1 veolcity/depth regime (usually slow-deep).

'4. Sediment Deposition	Optimal Little or no enlargeme of Islands or point ba and less than 5% (<2 for I;ow-gradient streams) of the bottor affected by sediment deposition.	rs bar formation, mostly from gravel, sand or fine sediment. 5-30% (new gravel, sand or fi sediment on old and 20- new bars; 30-50% (50-	ne material, increased bar development; more than 50% (80% for low-
	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1
5, Channel Flow Status	m/s. Optimal Water reaches base of both fower banks, and minimal amount of channel substrate is exposed.	available channel; or 25% of channel substrate is exposed.	available channel, and/or riffle substrates are mostly exposed.	channel and mostly present as standing pools.
SCORI 6, Channel Alteration	E 20 19 18 17 16 Optimal Channelization or dredging absent or minimal; stream with normal patter.	Suboptimal Some channelization present, usually in area of bridge abutements; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	or shoring structures present on both banks; and 40 - 80% of stream	ats gablon or cement over 80% of the stream reach channelized and
SCORE	20 19 18 17 16	15 1 13 12 11	10 9 8 7 6	5 4 3 2 1
7. Frequency of Riffles (or bends)	Optimal Occurrence of riffles relatively frequent ratio of distance bitw. riffled divided by width of the stream <7:1 *generally to 7); variety of habitats if key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important	Suboptimal Occurrence of riffles Infrequent; distance btw. riffles divided by the width of the stream Is btw. 7 to 15.	Marginal Occasional rifile or bend; bottom confours provide saome habitat; distance bow. riffles divided by the width of the stream is btw. 15 to 25	Poor Generally all flat water or shallow riffles; poor habitat; distance btw. riffles dividied by the width of the stream is a ration of >25%.
SCORE	20 19 18 17 16	15 14 1 12 11	10 9 8 7 6	5 4 3 2 1
	Optimal Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Suboptimal Moderately stable; infrequent, small areas of crosion mostly healed over, 5-30% of bank in reach has areas of crosion.	Marginal Moderately unstable, 30- 60% of bank in reach has areas of erosion; high erosion potential during floods.	Poor Unstable; meny eroded areas "raw" areas
SCORE RB		8 Ø G	5 4 3	2 1 0
Protection (score each bank)	Optimal	Suboptimal 70-90% of stream bank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	5 4 3 Marginal 50-70% of the stream bank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less then one-half of the potential plant stuibble height remaining.	Poor Less than 50% of the stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 5 cm or less in average stubble height.
SCORE RB 1	0 9	6 7 6	5 4 3	2 1 0
SCORE LB 1	0 9 plimal	8 (7) 6 Suboptimal	5 4 3 Marginal	2 1 0 Poor
Vegetative Zone Width W (score each bank) > (l.		Width of riparian zone 12-18 m; human activites have impacted zone	Width of riparian zone 6-12 m; human activiteid have impacted zone a	Width if riparian zone <6 m; little or no riparian yegetation due to human activities.
SCORE RB 10 SCORE LB 10				2 1 0 2 1 0 SCORE

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	ć	ocation:		to haul rd.	The second secon	3:50
on can remo: 1X	army rom	Journal of the second of the s	TIGGOCES II	TO TRACE TO		
Date; Stream Physico		atitude; 37	,00595°N	Longitude:	82.72583°W	
Instrument ID number Temperature: [3] Dissolved Oxygen:		Did	ductivity: _/instrument pas	uS/cm ss all post-calibration of ameter(s) failed and ac		
Benthic Macroin	rvertebrate Collec	tion				
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	la one) Goo (circle one) Riffi			or None niks Vegetation	Area Sampled	(sq. m.):
Recent precipitation Stream flow (circle) INSTREA FEATURE	Ircle one) Gloud (circle one) Clear one) Low M WATERSHED SS:	(Showe Worma) LOCAL WA	rs) Rain	ve Normal Floo ATUREES;	Other	
Stream Wid	ith <u>18</u> ft epth <u>6.2 - 1.0</u> ft	Surface Min		θ Construction	● Forest	
Average Ve	elocityft/s	Deep Mining		0 Commercial	θ Pasture/Grazin	9
Discharge Est. Reach	cfs	θ Oil Wells θ Land Dispos	ol.	0 Industrial 0 Row Crops	θ Silviculture θ Urban Runoff/S	Storm Sewers
0 Island 0 Other Riparian Ve Dominate T	9 Bridge Abutments 9 Waterfalls 9 Egetation: Donn. Tree type: Replay	Shrub Taxa	Stream Flow: Dry 0 Poo High 0 Ve Canopy Cover: Fully Shaded Partially Shade	ry Rapid or Torrential Cha (75-100%) θ Dr led (50-75%) θ Cl	Stream Type: Perennial 0 II Region Region	
Grasses 6 Number of s			Fully Exposed		iii Orai tiat)	
Substrate 0	Est. 0P.C.	Riffle 45	%	Run_55 %	Pool_C	<u>%</u>
Farmania v. A. V.	and the state of t	HighGrad	lient Habitat	Data Sheet		
1. Epifaunal Substrate/Available Gover	Optimal Greater then 70% of subst fayorable for epifauna colonization and fish cove mix of snags, submerged logs, undercut banks, cob or other stable habitat and stage to allow full coloniza potential (i.e. logs/snags t are not new fall and not tranisont).r	well suited for adequate habite maintenance at presence of a tion substrate in that fall, but not yet.	of stable habitat; or full potential; sitat for of populations; dd ittonal he form of new at prepared for nay rate at high	Marginal 20-40% mix of stable habitat; habitat availability less than desirable; sbustrate frequently disturbed or removed.	Poor Less than 20% stabl habitat, lack of habitat obvious; substrate unstable or lacking.	
	E 20 19 18 17 16	15 🐠 13		10 9 8 7 G	5 4 3 2 1	
. Embeddedness	Optimal Gravel, cobble, and boulder particles are 0- 25% surrounded by fine sedIment. Layering of cobble provides diversity of niche space	50% surroun	ble, and licles are 25- nded by fine	Marginal Gravel, cobble, and boulder particles are 50 75% surrounded by fine sediment.	more thath 75% surrounded by fine sediment.	
SCORE Velocity/Depth	20 19 18 17 16	15 (T) 13 Suboptir		10 9 8 7 6 Marginal	5 4 3 2 1 Poor	
velocity/Depth egime	Optimal CoverAll four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). Slow is	Only 3 of the present (if fa is missing, s	4 regimes of st-shallow of street str	wargman Only 2 of the 4 habitat regimes present (if fast- shallow or slow-shallow are missing, score low)	Dominated by 1 veolcity/depth regime (usually slow-deep).	
SCORE	<0.3 m/s, deep ls >0.5 20 19 18 17 16	15 14 13	12 11	PS 9 8 7 6	5 4 3 2 1	

4. Sediment Optimal Suboptimal Marginal Poor Little or no enlargement Heavy deposits of fine Deposition Some new increase in Moderate deposition of of Islands or point bars and less than 5% (<20% bar formation, mostly new gravel, sand or fine material, increased bar development; more than 50% (80% for lowsediment on old and from gravel, sand or for I; ow-gradient fine sediment. 5-30% (20new bars; 30-50% (50streams) of the bottom gradient) of the bottom 50% for low-gradlent) of 80% for low-gradient) of affected by sediment the bottom affected; changing frequently; deposition. slight deposition in pools almost absent. SCORE pools. 20 19 18 17 16 15 14 13 (12) 11 10 9 8 7 4 3 2 1 m/s. Optimal Poor Suboptimal Marginal 5. Channel Flow Water reaches base of Water fills >75% of the Water fills 25-75% of the Very little water in Status both lower banks, and available channel; or avallable channel, channel and mostly minimal amount of 25% of channel and/or riffle substrates present as standing channel substrato Is substrate is exposed. pools. are mostly exposed. exposed. SCORE 20 19 18 17 16 14 13 12 11 10 9 8 7 6 5 4 3 2 1 6. Channel Alteration Optimal Suboptimal Poor Marginal Some channelization Banks shored with Channelization or Channelization may be dredging absent or present, usually in areas extensive; embankments gablon or cement over minimal; stream with of bridge abutements; 80% of the stream reach or shoring structures channefized and normal patter. evidence of past present on both banks; channelization, i.e., disrupted. Instream and 40 - 80% of stream reach channelized and habitat greatly altered or dredging, (greater than past 20 yr.) may be disrupted. removed entirely. present, but recent channelization is not present. SCORE 20 19 18 17 16 15 14 13 (2)11 4 3 2 1 10 9 8 7 7. Frequency of Riffles Optimal Suboptimal Poor Marginal (or bends) Occurrence of riffles Occurrence of riffles Occasional riffle or Generally all flat water relatively frequent ratio Infrequent; distance bend; bottom contours or shallow riffles; poor of distance blw. riffled btw. riffles divided by provide saome habitat; habitat; distance btw. distance btw. riffles riffles dividied by the divided by width of the the width of the stream stream <7:1 *generally 5 divided by the width of width of the stream is a Is blw. 7 to 15. ration of >25%. to 7); variety of habitats the stream is blw. 15 to if key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important. SCORE 20 19 18 17 16 15 (4) 13 12 11 10 9 8 7 6 4 3 2 1 8. Bank Stability Suboptimal Optimal Marginal Poor (score each bank) Banks stable; evidence Moderately stable; Moderately unstable, 30-Unstable; many eroded of erosion or bank Infrequent, small areas 60% of bank in reach areas "raw" areas has areas of erosion; failure absent or of eroslon mostly healed over. 5-30% of minimal; little potential high erosion potential for future problems. ≺ bank in reach has areas during floods. 5% of bank affected. of croslon. 8 7 G SCORE RB 10 9 5 4 3 2 1 0 8 7 6 SCORE LB 10 9 5 4 3 2 1 0 9. Vegetative Optimal Suboptimal Marginal Poor Protection (score each More than 90% of the 50-70% of the stream Less than 50% of the 70-90% of stream bank bank) stream bank surfaces stream bank surfaces surfaces covered by bank surfaces covered and Immediate riparian native vegetation, but by vegetation: covered by vegetation: zone covered by native one class of plants is disruption obvious; disruption of stream not well-represented; patches of bare soll or bank vegetation is very vegetation, including disruption evident but high; vegetation has trees, understory closely cropped not affecting full plant shrubs, or non-woody vegetation common; been removed to 5 cm less then one-half of the macrophyles; vegetative growth potential to any or less in average potential plant stulbble great extent; more than stubble height. disruption through height remaining. grazing or mowing one-half of the potential minimal or not evident: plant stubble height almost all plants romaining. allowed to grow naturally. SCORE RB 10 9 6 **(3)** 4 1 0 SCORE LB 10 9 8 7 6 (3) 4 3 2 1

Vegetative Zone Width Width of riparian zone

Optimal

>18 m; human activities

roadbaeds, clear-cuts,

lawns, or crops) have not impacted zone.

(i.e. parking lots,

10. Riparian

(score each bank)

Suboptimal

only minimally.

Width of riparian zone

have impacted zone

12-18 m; human activites

great deal.

Marginal

Width of riparlan zone

6-12 m; human activiteid

have impacted zone a

Poor

Width If riparian zone

riparian vegetation due

<6 m; little or no

to human activities.

SCORE

Stallen ID: 11	OO AL BOEKS		roinvertebi	rate Field Dat	a Sheet (front)	Mining
	99.01 BRFK3	Ecoregion:		المام المامان	Start Time:	12:40
	EB, BWB, JOD	Survey Reason:	Bio. Mov			
•	coving Fork	_ Location:	100m ab	ove haul rd	BNICZOYS	
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otteam i nysic						
Instrument ID numb Temperature: 10 Dissolved Oxygen:	er: <u>YST- PRO</u> 	Cor Did	nductivity: _L instrument pa	us/cm uss all post-calibra ameter(s) failed a	tion checks? Y/N nd action	Name of the American Control o
Benthic Macro	invertebrate Col	lection				
Method used (c)	rcle one)	Single Habital	(Riffle)	Mul	ti Habitat (Logs, pl	ants, etc)
- 10 10 10 10 10 10 10 10 10 10 10 10 10		Good Mar	ginal) Po	oor None		
Habitats sampled	(circle one)	Riffle Sna	gs B	anks Vegeta	lion Area Sar	npled (sq. m.): Zin2
# Jabs						Cin
Weather Obser		loudy Clear	Pal	n/Snow Foggy		
		clear Show		및 1900의 설계 (ASSE) -	Other	
Recent precipitation Stream flow (circl	(circle one) Gl			ve Normal	Flood	
	AM WATERSHED					
FEATUR			TERSHED FE Surrounding La			
Stream W					etion Forest	
Range of	Depth 0.2 - 1.0 ft	Surface Min		O Construction O Commer		Grazina
Average 'Discharge		Vs	ă	O Industria		
Est. Reac		θ Land Dispo	sal	0 Row Cro		lunoff/Storm Sewers
	Structures:		Stream Flow:		Stream	al θ Intermittent
θ Dams	0 Bridge Abutments			oled θ Low (ery Rapid or Torrent		meral 0 Seep
0 Island	0 Waterfalls		θ High θ Ve	ay Kapid of Forrent	тат о дрис	metal o beep
θ Other	Vegetation: Dom.	Tree/Shrub Taxa	Canopy Cover:		Channel Alterations:	
Dominate			O Fully Shaded	(75-100%)	θ Dredging	
@ Trees	71000		O Partially Shad		θ Channelization	
*	Herbaceous Popl	~~	Partially Exp	osed (25-50%)	(0Full 0Partial)	
Number o	fstrata 3		OFully Exposed	l (0-25%)		
Substrate	θEst. 0P.C.	Riffle 40	%	Run_ 60	% Poo	1%
Tonada (FA)			The second secon	t Data Sheet		
	Optimal	Subon		Marginal	Poor	
. Epifaunal		substrate 40-70% mts				% stable
Substrate/Available		well suited f	or full	habitat; habitat	habitat, lack o	
cover	colonization and fish			availability less th		
	mix of snags, submer logs, undercul banks,		bitat for of populations;	destrable; sbustra frequently disturb		orang.
	or other stable habita	t and at presence of	additional	or removed.		
		onization substrate in ags that fall, but not y				
	are not new fall and n	ot colinzation (may rate at high			
ا د مدونی <u>دی</u> ان	tranisont).r	end of scale)				
	RE 20 19 18 17	49.000 (10.000 M)		10 9 8 7 6		1
Embeddedness	Optimal Gravel, cobble, and	Subopt Gravel, cob		Marginal Gravel, cobble, an	Poor d Gravel, cobble	, and
	boulder particles a	re 0- boulder par	rticles are 25-	boulder particles a	re 50- boulder partile	es are
	25% surrounded by	fine 50% surrou	inded by fine	75% surrounded b		
	sediment. Layering cobble provides	of sediment.		sediment.	surrounded by sediment.	IIIIa
	diversity of niches	pace,				
SCO	RE 20 19 18 17		12 11	10 9 8 7 6	5 4 3 2	1
Velocity/Depth	Optimal	Subopti		Marginal	Poor	
egime	CoverAll four			Only 2 of the 4 hab	itat Dominated by 1	e elus e
	velocity/depth regin			regimes present (if shallow or slow-sh		
	present (slow-deep, slow-shallow, fast-d			are missing, score		colch
	fast-shallow). Slow				ereanisti (Financia)	
	<0.3 m/s, deep is >0	.5				
SCOR	E 20 19 18 17 1	6 15 14 13	12 11 /	10)9876	5 4 3 2	1

4. Sediment Optimal Suboptimal Marginal Poor Little or no enlargement Deposition Some new increase in Moderate deposition of Heavy deposits of fine of Islands or point bars bar formation, mostly new gravel, sand or fine material, increased bar and less than 5% (<20% from gravel, sand or sediment on old and development; more than for I; ow-gradient fine sediment. 5-30% (20new bars; 30-50% (50-50% (80% for lowstreams) of the bottom 50% for low-gradlent) of 80% for low-gradient) of gradient) of the bottom affected by sediment the bottom affected; changing frequently; deposition. slight deposition in pools almost absent. SCORE pools. 20 19 18 17 16 15 14 13 12 (11) 10 9 8 7 5 4 3 2 1 m/s. Optimal Suboptimal Marginal Poor 5, Channel Flow Water reaches base of Water fills >75% of the Water fills 25-75% of the Very little water in Status both lower banks, and available channel; or avallable channel, channel and mostly minimal amount of 25% of channel and/or riffle substrates present as standing channel substrate Is substrate is exposed. are mostly exposed. pools. exposed. SCORE 20 19 18 17 16 10 9 8 7 6 (15) 14 13 12 11 5 4 3 2 1 6. Channel Alteration Optimal Suboptimal Marginal Poor Channelization or Some channelization Channelization may be Banks shored with dredging absent or present, usually in areas extensive; embankments gablon or cement over minimal; stream with of bridge abutements; or shoring structures 80% of the stream reach normal patter. evidence of past present on both banks; channefized and channelization, i.e., and 40 - 80% of stream disrupted. Instream dredging, (greater than reach channelized and habitat greatly altered or past 20 yr.) may be disrupted. removed entirely, present, but recent channelization is not present. SCORE 20 19 18 17 16 15 14 13 (2) 11 10 9 8 7 5 4 3 2 1 7. Frequency of Riffles Optimal Suboptimal Poor Marginal (or bends) Occurrence of riffles Occurrence of riffles Occasional riffle or Generally all flat water relatively frequent ratio Infrequent; distance bend; bottom contours or shallow riffles; poor of distance blw. riffled btw. riffles divided by provide saome habitat; habitat; distance btw. divided by width of the the width of the stream distance btw. riffles riffles dividied by the stream <7:1 *generally 5 Is btw. 7 to 15. divided by the width of width of the stream is a to 7): variety of habitats ration of >25%. the stream is btw. 15 to If key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important. SCORE 20 19 18 17 16 15 4 13 12 11 10 9 8 7 6 4 3 2 1 8. Bank Stability Optimal Suboptimal Marginal Poor (score each bank) Banks stable; evidence Moderately stable; Moderately unstable, 30-Unstable; many eroded of erosion or bank Infrequent, small areas 60% of bank in reach areas "raw" areas failure absent or of erosion mostly has areas of erosion; minimal; little potential healed over, 5-30% of high erosion potential for future problems. < bank in reach has areas during floods. 5% of bank affected. of croslon. 9 SCORE RB 10 9 8 G 5 4 3 2 1 0 SCORE LB 9 10 8 6 5 4 3 2 1 0 9. Vegetative Optimal Suboptimal Marginal Poor Protection (score each More than 90% of the 70-90% of stream bank 50-70% of the stream Less than 50% of the bank) stream bank surfaces surfaces covered by bank surfaces covered stream bank surfaces and Immediate riparian native vegetation, but by vegetation; covered by vegetation; zone covered by native one class of plants is disruption obvious; disruption of stream not well-represented; vegetation, including bank vegetation is very patches of bare soll or trees, understory shrubs, or non-woody disruption evident but closely cropped high; vegetation has not affecting full plant vegetation common; been removed to 5 cm macrophyles; vegetative growth potential to any less then one-half of the or less in average disruption through great extent; more than potential plant stulbble stubble height. grazing or mowing one-half of the potential height remaining. minimal or not evident; plant stubble height

SCORE RB 10

SCORE LB 10 10. Riparian Optimal

Vegetative Zone Width Width of riparian zone (score each bank)

>18 m; human activities (i.e. parking lots, roadbaeds, clear-cuts, lawns, or crops) have not impacted zone.

almost all plants

allowed to grow naturally.

9

SCORE RB 10 SCORE LB 10 only minimally.

8 7

7

6

Suboptimal Width of riparian zone 12-18 m; human activites have impacted zone

remaining.

(B) 7 (B)

4 5 4 3 Marginal Width of riparian zone 6-12 m; human activiteld have Impacted zone a great deal.

5 4 3

2 1 0 Poor Width if riparian zone <6 m; little or no to human activities.

riparian vegetation due

1

1

0

2

Fleld Team: JE	0.01-BRFK4 E	urvey Reason: Bio. C	brate Field Data Sh nonitoring nt to howl cd	eet (front) Land Use Mining Start Time: 11:40 Finish Time: 12:10
Date: 3 Stream Physica		alilude; 36.98554	Longitude; _{	32.72417
Instrument ID number Temperature:I2. Dissolved Oxygen:	E _YSI - PRO B _Co [2.14 mg/l	pH: <u>4.3</u> Conductivity: Did instrument If NO - which p	7 us/cm pass all post-calibration of arameter(s) falled and act	necks? Y/N ion
Method used (circle) Riffle Quality (circle)	overtebrate Collections) Sing Good Grade one) Good Riffic	le Habitat (Riifle)	Multi Hab Poor None Banks Vegelation	itat (Logs, plants, etc) Area Sampled (sq. m.): 2m²
Recent precipitation Stream flow (circled INSTREAM	(circle one) Cloud (circle one) Clear one) Low	Showers Ra	pove Normal Flood	ther
	th <u>20</u> ft epth <u>6.2-2-5</u> ft locity ft/s	Predominant Surrounding I Surface Mining Deep Mining Oil Wells Land Disposal	end Use: O Construction Commercial Industrial Row Crops	Forest Pasture/Grazing Silviculture Urban Runoff/Storm Sewers
0 Island 6 Other Riparian Ve Dominate T Trees	Bridge Abutments Waterfalls getation: Dom. Tree/ ype; Sycamo Shrubs Poplar Herbaceous	Shrub Taxa Canopy Cove O Fully Shad Partially Si O Partially Ex	Pooled θ Low	θ Ephemeral θ Sèep
Number of s Substrate 0		OFully Expos	ed (0-25%) Run <u>40</u> %	Pool_S_%
1. Epifaunal Substrate/Available Cover	Optimal Greater then 70% of substration favorable for epifauna colonization and fish cover mix of snags, submerged logs, undereut banks, cobbor other stable habitat and slage to allow full colonizat	HighGradient Habit Suboptimal ale 40-70% mis of slable habita well suited for full colonization potential; adequate habitat for maintenance of populations.	Marginal i; 20-40% mix of stable habitat; habitat availability less than desirable; sbustrate frequently disturbed or removed.	Poor Less than 20% stable habitat, lack of habitat is obvious; substrate unstable or lacking.
SCORE 2. Embeddedness	Optimal Gravel, cobble, and boulder particles are 0- 25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	15 (4) 13 12 11 Suboptimal Gravel, cobble, and boulder particles are 25- 50% surrounded by fine sediment.	10 9 8 7 6 Marginal Gravel, cobble, and boulder particles are 50- 75% surrounded by fine sediment.	Poor Gravel, cobble, and boulder partitices are more thatn 75% surrounded by fine sediment.
SCORE 3. Velocity/Depth Regime	20 19 18 17 16 Optimal CoverAll four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). Slow is	Suboptimal Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	10 9 8 7 6 Marginal Only 2 of the 4 habitat regimes present (if fast- shallow or slow-shallow are missing, score low).	5 4 3 2 1 Poor Dominated by 1 veolcity/depth regime (usually slow-deep).
SCORE	<0.3 m/s, deep is >0.5 20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1

'4. Sediment Deposition SCOR	Optimal Little or no enlargeme of Islands or point ba and less than 5% (<20 for I;ow-gradient streams) of the botton affected by sediment deposition.	bar formation, mostly from gravel, sand or fine sediment. 5-30% (m 50% for low-gradient)	new gravel, sand or fir sediment on old and 20- new bars; 30-50% (50- of 80% for low-gradient) o	ne material, increased bar development; more than 50% (80% for low-
	20 19 18 17 16 m/s.	3 15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
5, Channel Flow Status	Optimal Water reaches base of both lower banks, and minimal amount of channel substrato is exposed.	available channel; or 25% of channel substrate is exposed.	Marginal Water fills 25-75% of th available channel, and/or riffle substrates are mostly exposed. 10 9 8 7 6	channel and mostly
6. Channel Alteration	E 20 19 18 17 16 Optimal Channelization or dredging absent or minimal; stream with normal patter.	Suboptimal Some channelization present, usually in area of bridge abutements; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Marginal Channelization may be s extensive; embankment or shoring structures present on both banks; and 40 - 80% of stream	Poor Banks shored with
SCOR	E 20 19 18 17 16	15 14 13 12	10 9 8 7 6	5 4 3 2 1
7. Frequency of Riffle (or bends)	Optimal Occurrence of riffles relatively frequent ratio of distance blw. riffled divided by width of the stream <7:1 *generally & to 7): variety of habitats if key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important	btw. riffles divided by the width of the stream 5 is btw. 7 to 15. 6	Marginal Occasional riffle or bend; bottom contours provide saome habitat; distance btw. riffles divided by the width of the stream is btw. 15 to 25.	Poor Generally all flat water or shallow riffles; poor habitat; distance btw. riffles dividied by the width of the stream is a ration of >25%.
	20 19 18 17 16	15 14 13 ② 11	10 9 8 7 6	5 4 3 2 1
8. Bank Stability (score each bank)	Optimal Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Suboptimal Moderately stable; Infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Marginal Moderately unstable, 30- 60% of bank in reach has areas of erosion; high erosion potential during floods.	Poor Unstable; many eroded areas "raw" areas
SCORE RB		8 7 G	© 4 3	2 1 0
	Optimal More than 90% of the stream bank surfaces and Immediate riparian zone covered by native vegetation, including frees, understory shrubs, or non-woody macrophyles; vegetative disruption through grazing or mowing minimal or not evident; allowed to grow naturally.	great extent; more than one-half of the potential plant stubble height remaining.	height remaining,	2 1 0 Poor Less than 50% of the stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 5 cm or less in average stubble height.
SCORE RB SCORE LB		8 7 6 8 7 6		2 1 0 2 1 0
10. Riparian Vegetative Zone Wichh ((score each bank) (Optimal	Suboptimal Width of riparian zone 12-18 m; human activites have impacted zone	Marginal Width of riparian zone 6-12 m; human activiteid have impacted zone a	Poor Width If riparian zone <6 m; little or no riparian vegetalion due o human activities.
SCORE RB 1 SCORE LB 1			5 4 3 2 5 4 3 2	

Field Team: De Stream Name: Co	19.01-BCPTI EB, BWB, JOD Line Potch Broad Creek	Ecoregion: Survey Reason: A Location:	Bio, Monito	o haul Rd.	Land Use Min	2
Stream Physico	chemical					
Instrument ID number Temperature: [\], Dissolved Oxygen:		Cond Did ir	S117 uctivity: _807 istrument pass a 0 - which parame	us/cm I post-calibration ch ter(s) failed and acti	ecks? Y/N on	
Benthic Macroir	vertebrate Coll	ection			35.3417.711	315:65 31316.8
Riffle Quality (circl	e one) G	ingle Habital (F god Margii lifile Snags		Multi Habi None Vegelation	tat (Logs, planis, etc) Area Sampled (sq.	m.): 2m²
Recent precipitation Stream flow (circle)	role one) Cle (circle one) Cle one) Low VI WATERSHED S:	Normal LOCAL WAT	Rain/Sno Rain Above No ERSHED FEATU	Storms Ot ormal Flood REES;	her	
Stream Wid Range of Do Average Ve Discharge Est, Reach I	epth <u>6.20-2</u> ft locityft/	Surface Mining Deep Mining	g	O Construction O Connitercial Industrial Row Crops	Prorest Prorest Pasture/Grazing Silviculture Urban Runoff/Storn	1 Sewers
0 Island 0 0 Other Riparian Ve	Bridge Abutments Waterfalls getation: Dom. Tom. Tom. Sype; Sycam Shrubs Hem to Herbaceous Romen	ree/Shrub Taxa Canove O	nnopy Cover; Fully Shaded (75-1 Partially Shaded (5 Partially Exposed (Jully Exposed (0-2)	00%) θ Dred 0-75%) θ Chan 25-50%) (θFull 5%)	θ Ephemeral θ Se el Alterations; ging melization θPartial)	ер
Substrate 01	Est. 0P.C.	Riffle 40 %		Run_45_%	Paol_ 15 %	6
1. Epifaunal Substrate/Available Cover	Optimal Greater then 70% of sui favorable for epifauna colonization and fish oc mix of snags, submerce logs, undercut banks, o or other stable habilat a stage to allow full colon potential (i.e. logs/snag are not new fall and not tranisent).r	Suboptin belrate 40-70% mis of well suited for t ever; colonization po adequate habite obble maintenance of nd at presence of ade ization substrato in the s that fall, but not yet	stable habitet; 20- uil hab tential; avai et for desi populations; freq or re form of new prepared for	Marginal	Poor Less than 20% stable habitat, lack of habitat is obvious; substrate unstable or lacking.	
	20 19 18 17 16	15 (4) 13		9 8 7 6	5 4 3 2 1	
2. Embeddedness	Optimal Gravel, cobble, and boulder particles are 25% surrounded by f sediment. Layering o cobble provides diversity of niche spa	ine 50% surround f sediment.	e, and Grav les are 25- bould ed by fine 75% sedir	Marginal el, cobble, and der particles are 50- surrounded by fine nent.	Poor Gravel, cobble, and boulder partites are more thatn 75% surrounded by fine sediment.	
	20 19 18 17 16			[1] - 시민도는 - #	5 4 3 2 1 Poor	
8. Velocity/Depth Regime	Optimal CoverAll four velocity/depth regime present (slow-deep, slow-shallow, fast-dee fast-shallow). Slow is <0.3 m/s, deep is >0.5	is missing, sco than if missing regimes).	regimes Only -shallow regim ore lower shallo other are n	Marginal 2 of the 4 habitat es present (if fast- ow or slow-shallow aissing, score low).	Dominated by 1 veolcity/depth regime (usually slow-deep).	
· score	20 19 18 17 16	15 14 🔞 1	2 11 10 9	8 7 6	5 4 3 2 1	

4. Sediment Poor Optimal Suboptimal Marginal Heavy deposits of fine Deposition Little or no enlargement Some new increase in Moderate deposition of of Islands or point bars bar formation, mostly material, increased bar new gravel, sand or fine and less than 5% (<20% from gravel, sand or sediment on old and development; more than new bars; 30-50% (50-50% (80% for lowfor I; ow-gradient fine sediment. 5-30% (20streams) of the bottom 50% for low-gradlent) of 80% for low-gradient) of gradient) of the bottom changing frequently; affected by sediment the bottom affected: slight deposition in pools almost absent. deposition. SCORE pools. 10 9 (8) 7 5 4 3 2 1 20 19 18 17 16 15 14 13 12 11 m/s. Optimal Poor' Suboptimal Marginal 5, Channel Flow Water fills >75% of the Water fills 25-75% of the Very little water in Water reaches base of available channel; or avallable channel, channel and mostly Status both lower banks, and present as slanding and/or riffle substrates minimal amount of 25% of channel channel substrato is substrate is exposed. are mostly exposed. pools. exposed. SCORE 20 19 18 17 16 14 13 12 11 9 8 7 6 5 4 3 2 1 Poor 6. Channel Alteration **Optimal** Suboptimal Marginal Banks shored with Channelization or Some channelization Channelization may be dredging absent or present, usually in areas extensive; embankments gablon or cement over minimal; stream with of bridge abutements; or shoring structures 80% of the stream reach normal patter. evidence of past present on both banks; channelized and channelization, i.e., and 40 - 80% of stream disrupted. Instream dredging, (greater than reach channelized and habitat greatly aftered or past 20 yr.) may be disrupted. removed entirely. present, but recent channelization is not present. 5 4 3 2 1 SCORE 20 19 18 17 16 15 14 13 12 (11) 10 9 8 7 6 Poor 7. Frequency of Riffles Suboptimal Optimal Marginal Generally all flat water (or bends) Occurrence of riffles Occurrence of rifiles Occasional riffle or relatively frequent ratio of distance blw. riffled Infrequent; distance bend: bottom confours or shallow riffles; poor btw. riffles divided by provide saomo habitat; habitat; distance btw. riffles dividied by the divided by width of the stream <7:1 *generally 5 distance btw. riffles the width of the stream divided by the width of width of the stream is a Is btw. 7 to 15. ration of >25%. the stream is blw. 15 to to 7); variety of habitats If key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important. SCORE 20 19 18 17 16 15 14 13 12 11 10 9 8 7 4 3 2 1 8. Bank Stability Optimal Suboptimal Marginal Poor (score each bank) Moderately stable; Moderately unstable, 30-Unstable; many eroded Banks stable; evidence 60% of bank in reach Infrequent, small areas areas "raw" areas of erosion or bank has areas of erosion: failure absent or of erosion mostly minimal; little potential healed over, 5-30% of high erosion potential during floods. for future problems. < bank in reach has areas 5% of bank affected. of eroslon. SCORE RB 10 9 8 7 G 3 2 1 0 2 1 SCORE LB 10 9 8 7 6 (5) 3 9. Vegetative Suboptimal Marginal Poor Optimal Protection (score each More than 90% of the 70-90% of stream bank 50-70% of the stream Less than 50% of the stream bank surfaces bank) surfaces covered by bank surfaces covered stream bank surfaces covered by vegetation: native vegelation, but by vegetation; and immediate riparian disruption of stream disruption obvious; zone covered by native one class of plants is bank vegetation is very patches of bare soll or vegetation, including not well-represented; high; vegetation has trees, understory disruption evident but closely cropped been removed to 5 cm shrubs, or non-woody not affecting full plant vegetation common: less then one-half of the macrophyles; vegetative growth potential to any or less in average disruption through great extent; more than potential plant stuibble stubble height. grazing or mowing one-half of the potential height remaining. minimal or not evident; plant stubble height almost all plants remaining. allowed to grow naturally. SCORE RB 10 7 6 9 8 SCORE LB 10 0 7 (6) 9 8 4 3

Vegetative Zone Width Width of riparian zone

Optimal

>18 m; human activities

roadbaeds, clear-cuts,

lawns, or crops) have not impacted zone.

(I.e. parking lots,

10. Riparian

(score each bank)

Suboptimal

only minimally.

Width of riparian zone

have impacted zone

12-18 m; human activites

Marginal

great deal.

Width of riparlan zone

6-12 m; human activite id have impacted zone a Poor

Width if riparian zone <6 m; little or no

riparian vegetation due

to human activities.

Station ID:	1	Benthic Macroii Ecoregion:	nvertebrate Field Data Si	heet (front) Land Use	
Fleld Team:		· · · · · · · · · · · · · · · · · · ·	Bio. Monitorina	Start Time: 15:16	_
Stream Name:			Om above old haul rd	Finish Time: 15:45	
	TOOK IN WITE	-	crossing.		
Date: Stream Phys		Latitude; 37.0	12-71°N Longitude: (12, 69608°W	
Dissolved Oxygen	H L Co : <u>U-40 mg/l</u>	If NO -	S. I.2. divity: _VGus/cm rument pass all post-calibration of which parameter(s) falled and according to the parameter of the pa		
	oinvertebrate Collec				
	circle one) Sing	gle Habilab (Riffle d (Marginal	<u> </u>	bitat (Logs, plants, etc)	
Habitats sampled # Jabs	(circle one)	Snags	Banks Vegelation	Area Sampled (sq.m.): 2m ²	<u>-</u>
INSTRE FEATU	(circle one) Çiouc (circle one) Cloar de one) Low EAM WATERSHED RES:	Normal	Above Normal Floo SHED FEAT UREES;	Other d	
Stream V Range of Average Discharg Est. Reac	Depth 0.2-1.0 ft Velocity ft/s e cfs	Surface Mining Deep Mining θ Oil Wells θ Land Disposal	Onstruction Conntercial Industrial Row Crops	Forest O Pasture/Grazing O Silviculture Urban Runoff/Storm Sewers	
O Dams O Island O Other Riparian Dominate O Trees O Grasses	Type: Poorlas	9 Dry 9 Hig Shrub Taxa Canop Θ Ful. Part Θ Part	by Cover: Chan by Shaded (75-100%) θ Dre ially Shaded (50-75%) θ Chr	Stream Type: al Perennial 0 Intermittent	
		Riffle 50 %	Run_45_%	Pool_ 5 %	
1. Epifaunal Substrate/Available Cover	colonization and fish cover, mix of snags, submerged logs, undercut banks, cobbi or other stable habitat and a stage to allow full colonizati potential (i.e. logs/snags the are not new fall and not tranisent).r	Suboptimal ale 40-70% mis of slab well suited for full colonization potenti adequate habitat for maintenance of pop presence of addition substrate in the form at fall, but not yet prep- colinization (may rate end of scale).	habitat; habitat as valiability less than clestrable; sbustrate frequently disturbed or removed. ared for at high	Poor Less than 20% stable habitat, lack of habitat is obylous; substrate unstable or lacking.	
SCOR 2. Embeddedness	RE 20 19 18 17 16	(15) 14 13 12		5 4 3 2 1 Poor	
	Optimal Gravel, cobble, and boulder particles are 0- 25% surrounded by fine sediment. Layering of cobble provides diversity of niche space, 5 20 19 18 17 16	Suboptimal Gravel, cobble, an boulder particles a 50% surrounded b sediment.	pre 25- boulder particles are 50- by fine 75% surrounded by fine sediment.	Gravel, cobble, and boulder partitices are more thatn 75% surrounded by fine sediment.	
3. Velocity/Depth	Optimal	Suboptimal	Marginal	Poor	
Regime	CoverAll four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). Slow is <0.3 m/s, deep is >0.5	Only 3 of the 4 regi- present (if fast-sha is missing, score to than If missing oth regimes).	llow regimes present (if fast- ower shallow or slow-shallow	Dominated by 1 veoloity/depth regime (usually slow-deep).	

Deposition Little of istend little and little for l;o	Optimal or no enlargemen ands or point bars ess than 5% (<20' ov-gradient ns) of the bottom ed by sediment lition.	bar formation, most from gravel, sand or fine sediment. 5-30%	new gravel, sand or sediment on old an (20 new bars; 30-50% (5 t) of 80% for low-gradien	fine material, increased bar development; more than 50% (80% for low-
	19 18 17 16		1 10 9 8 7 6	5 4 3 2 1
m/s.		THE RESEARCH THE STREET		
5, Channel Flow Water Status both to minima channel expose		Suboptimal Water fills >75% of the available channel; or 25% of channel substrate is exposed	avallable channel, and/or riffle substrat are mostly exposed.	channel and mostly es present as standing pools.
SCORE 20 19 6. Channel Alteration O	ptlmal	(5)14 13 12 11 Suboptimal	10 9 8 7 6 Marginal	5 4 3 2 1 Poor
Channo dredgin	clization or ng absent or l; stream with	Some channelization present, usually in an of bridge abutements evidence of past channelization, i.e., dredging, (greater tha past 20 yr.) may be present, but recent channelization is not present.	channelization may be extensive; embankmo or shoring structures present on both bank and 40 - 80% of stroat	be Banks shored with sents gablon or cement over 80% of the stream reach s; channelized and disrupted instream
	18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1
(or bends) Occurrer relatively of distan divided be stream < 10 7); varif key. In riffies are placemen or other is	timal nce of riffles y frequent rallo ice blw. riffled by width of the 7:1 generally 5 lely of habitats streams where e continuous, at of boulders arge, natural	Suboptimal Occurrence of rifiles Infrequent; distance btw. rifiles divided by the width of the stream is btw. 7 to 15.	Marginal Occasional riffle or bend; bottom contours provide saome habitat, distance btw. riffles divided by the width of the stream is btw. 15 to 25.	habitat; distance blw. riffles dividied by the width of the stream is a
	on is important,	A	40 0 0 0 0	
SCORE 20 19 18. Bank Stability Option		15 (4) 13 12 11 Suboptimal	10 9 8 7 6 Marginal	5 4 3 2 1 Poor
(score each bank) Banks sta of erosion failure abs minimal; ii	ble; evidence or bank sent or ittle potential problems. <	octopumal Moderately stable; Infrequent, small areas of erosion mostly healed over, 5-30% of bank in reach has areas of crosion.	Moderately unstable, 30 60% of bank in reach has areas of erosion; high erosion potential during floods.	
SCORE RB 10 9	8		5 4 3 5 4 3	2 1 0
zone covere vegetation, frees, under shrubs, or n	90% of the 7 ik surfaces state riparian need by native or including normal story dispersive grant on wing on owing on tevident; plants	Suboptimal 0-90% of stream bank urfaces covered by ative vegetation, but ne class of plants is of well-represented; isruption evident but of affecting full plant rowth potential to any reat extent; more than ne-half of the potential ant stubble height maining.	Marginal 50-70% of the stream bank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less then one-half of the potential plant stulbble helght remaining.	Poor Less than 50% of the stream bank surfaces covered by Vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 5 cm or less in average stubble height.
SCORE RB 10 9	8	7 (g) 7 (g)	5 4 3	2 1 0
SCORE LB 10 9 10. Riparian Oplimal	8		5 4 3 Marginal	2 1 0 Poor
Vegetative Zone Width Width of ripa (score each bank) >18 m; huma (i.e. parking l roadbaeds, ci lawns, or croj not impacted	rian zone Wid in activities 12- lots, har lear-cuts, only ps) have	sboplimal dth of riparian zone 18 m; human activites vo impacted zone y minimally.	Marginal Width of riparian zone 6-12 m; human activiteid have impacted zone a great deal.	Poor Width If riparian zone <6 m; little or no riparian vegetation due to human activities.
SCORE RB 10 9 SCORE LB 10 9		•		2 1 0 2 1 0 SCORE

129

APPENDIX B:

TABLES

Table 1. Quantitative listings of macroinvertebrates collected 14 March 2012 from six aquatic sample sites for a surface mine permit number 1101760 in Wise County, Virginia.

Order	Family	Spring 2012					
		BRFK-1	BRFK-2	BRFK-3	BRFK-4	BCPT-1	BPR-1
Ephemeroptera	Ameletidae					1	1
	Baetidae				9	12	17
	Heptageniidae				1	1	
Plecoptera	Leuctridae						7
	Nemouridae	13	1	7	10	64	33
	Perlodidae						4
Trichoptera	Hydropsychidae	70	52	64	35	21	10
	Philopotamidae	1	2	1			
	Rhyacophilidae	1					
	Uenoidae					1	
Coleoptera	Elmidae						22
Diptera	Ceratropogonidae			1			
	Chironomidae	12	35	39	39	8	7
	Empididae	2	7	4	6	2	2
	Tipulidae	4	4		1		1
Megaloptera	Corydalidae					1	
	Sialidae	1					
Decapoda	Cambaridae		1				
Annelida	Oligochaeta	2	7	5	3	1	2
		106	109	121	104	112	106

Table 2. VSCI metrics calculated from the macroinvertebrates collected 14 March 2012 at six aquatic sample sites for surface mine permit number 1101760 in Wise County, Virginia

Family Metrics	Spring 2012							
	BRFK-1	BRFK-2	BRFK-3	BRFK-4	BCPT-1	BPR-1		
Taxa Richness	9	8	7	8	10	11		
EPT Taxa	4	3	3	4	6	6		
% Ephemeroptera	0	0	0	9.62	12.5	16.98		
% PT - Hydropsychidae	14.2	2.8	6.6	9.6	58	41.5		
% Scrapers	0	0	0	0.96	1.79	20.75		
% Chironomidae	11.32	32.11	32.23	37.5	7.14	6.6		
% 2 Dominant	78.3	79.82	85.12	71.15	75.89	51.89		
нві	5.28	5.7	5.73	5.38	3.38	3.35		
VSCI	38.31	28.82	28.71	36.18	56.12	66.66		

Table 3. Physiochemical water data collected 14 March 2012 at six aquatic sample sites for surface mine permit number 1101760 in Wise County, Virginia.

Parameter	BRFK-1	BRFK-2	BRFK-3	BRFK-4	BCPT-1	BPR-1
Temperature (Celsius)	12.6	13	12.6	12.8	11.9	14.1
Specific Conductance (µs)	1147	1182	1163	1180	807	965
рН	7.97	8.22	8.31	8.37	8.17	8.12
Dissolved Oxygen mg/l)	11.9	11.98	11.93	12.14	11.89	11.4

APPENDIX C:

PERSONNEL RESUMES



EDUCATION

Masters of Science, Biology, Eastern Kentucky University, Commenced 2003 Bachelors of Science, Wildlife Management, Eastern Kentucky University, 2001 Associates of Science, Southeast Community College, 1997

AREAS OF SPECIALIZATION

- Federally Threatened and Endangered Species Surveys: Aquatic and Terrestrial
- Threatened and Endangered Species Monitoring
- · Floral and Fauna Field Investigations
- Aquatic Surveys and Assessments
- USACE Permitting

SUMMARY OF QUALIFICATIONS

Mr. Isaac, a Senior Biologist /Project Manager for Appalachian Technical Services, Inc. has conducted numerous surveys for federally threatened and endangered species of flora and fauna both terrestrial and aquatic in several states. Mr. Isaac is qualified and proficient in; conducting terrestrial and aquatic biological assessments, bat surveys, mussel surveys, botanical surveys, small mammal surveys, fish surveys, crayfish surveys, macroinvertebrate collection and identification, water quality monitoring, USACE permit applications, stream delineation and classification, mitigation site assessments, wetlands delineations, and composing study plans and scientific reports.

Mr. Isaac is permitted by the:

- U.S. Fish and Wildlife Services
- West Virginia Division of Natural Resources
- Virginia Department of Game and Inland Fisheries
- Kentucky Department of Fish and Wildlife Resources
- North Carolina Wildlife Resource Commission

AQUATIC SURVEY EXPERIENCE

- Collection and identification of the freshwater mussel species of Kentucky, southwest Virginia, northeastern Tennessee, and central Ohio
- Qualitative surveys for live and relic freshwater mussels using snorkeling techniques and the use of viewing buckets
- Use of plot sampling to quantitatively survey freshwater mussels
- Field identification of live individuals and lab identification and curation of relict shells collected during surveys
- Assisted in numerous quantitative and qualitative mussel surveys with VDGIF, USFWS, USGS, Virginia Tech, and Steve Ahlstedt in Tennessee, Virginia, and Ohio
- Identification and curation of aquatic insects
- Quantitative and qualitative sampling methods for aquatic macroinvertebrates

- Virginia State Endangered variegate darter (Etheostoma variatum) surveys
- Federal Candidate Clinch Dace (Phoxinus sp. cf. saylori) surveys
- Stream habitat assessments for the Clinch Dace (Phoxinus sp. cf. saylori)
- Assisted in the two year monitoring of Federally Threatened blackside dace (*Phoxinus cumberlandensis*) in Colliers Creek, Letcher County, Kentucky
- Conducted the two year monitoring of Federally Threatened blackside dace (*Phoxinus cumberlandensis*) in Breedens Creek, Harlan County, Kentucky
- Exploratory surveys and population assessments for the federally threatened blackside dace (*Phoxinus cumberlandensis*)
- Virginia State Endangered big sandy crayfish (Cambarus veteranus) surveys
- Identification of the crayfish of Kentucky and southwest Virginia
- Identification and Ecology of the fishes of Kentucky and southwest Virginia
- Collection of physiochemical water quality data
- Application of Rosgen stream classification techniques
- Collection of fluvial geomorphologic stream data for mitigation and restoration
- Mitigation site assessments
- Drawing stream profiles and cross sections
- Wetlands delineations

TERRESTRIAL SURVEY EXPERIENCE

- Listed on the USFWS and KDFWR approved bat researchers list
- Identification of eastern forest bats including the Federally Endangered Indiana bat, Virginia big-eared bat, and the gray bat
- Bat surveys in Kentucky, Tennessee, Virginia, North Carolina, West Virginia, and Pennsylvania
- Surveys for federally threatened/endangered bats using mist nets and harp traps
- Monitoring studies of the Indiana bat
- Summer and wintering habitat evaluations for Indiana bats
- Summer roost emergence counts for Indiana bats
- Bridge evaluations for use by bats
- Abandoned mine evaluations for bat use
- Radio-Telemetry
- Accompanied KDFWR, USFS and USFWS personnel on Priority 1 and Priority 2
 Indiana bat and Virginia big-eared bat hibernacula counts in eastern Kentucky
- Co-hosted Mist Netting Workshop for WVDEP Personnel May 2006
- Mist netting and harp trapping at cave entrances of Priority 1 and Priority 2 hibernacula for Indiana bats and gray bats
- Identification of woody and herbaceous plants: aquatic and terrestrial
- Identification of small mammals; moles, shrews, voles, mice, jumping mice
- Established pitfall arrays for small mammal collecting and site selection of snap traps
- Identification and curation of small mammal specimens
- Experience identifying reptiles and amphibians
- Curation of amphibians and entry into museum database
- Identification of migratory birds and waterfowl of the Eastern US

RELATED COLLEGE CURRICULUM

Scientific Literature, Freshwater Invertebrates, Ichthyology, Aquatic Entomology, Aquatic and Wetland Plants, Mammology, Ornithology, Botany, Plant Systematics, Dendrology, Zoology, Wildlife Techniques, Ecology, Migratory and Residential Wildlife Management and Ecology, Field Studies in Wildlife, Wildlife Management, Wildlife Resource Policy and Administration, Big Game Ecology, Principles of Biological Systems, Animal Physiology, Evolution, Geographic Information Systems, Geology, Principles of Soils, and Cartography / Map Design.

CERTIFICATIONS AND TRAINING

2011 North American Benthological Society Eastern EPT Genus Level Taxonomic Certification

2010 North American Benthological Society Family Level Taxonomic Certification

2007 Bat Conservation International, Acoustic Monitoring Workshop

2007 Virginia Tech Coal Mining & the Aquatic Environment Symposium

PADI Open Water Scuba Diver with specialties; Drysuit Diver, Enriched Air Diver

2006 Bat Conservation International, Kentucky Workshop

Applied Fluvial Geomorphology, Level 1 Rosgen Certification

38 - Hour U.S.A.C.E. Wetland Delineation & Management Training Program

USDA Nuisance Animal Trapping Workshop

USDA Coyote and Bobcat Trapping Workshop

Pre-rabies exposure vaccination

Virginia Surface Miner Certificate (with annual MSHA Retraining)

OSHA Construction Safety & Health Training

PROFESSIONAL EXPERIENCE

Senior Biologist - ATS (July 2006 - Present)

Director of Ecological Services – Apogee Environmental Consulting, Inc. (April 2006 – July 2006)

Director of Ecological Services – ATS (Nov 2003 – April 2006)

Terrestrial Ecologist – ATS (April 2002 - Oct 2003)

Staff Ecologist – ATS (August 2001 – March 2002)

Biological Technician – ATS (June 2001 – August 2001)

Guide / Naturalist – Lilley Cornett Woods, (1999 and 2000)